Vacuum Assisted Tools and Glove Bags Reduce Chromium VI Exposure During Aircraft Corrosion Control Work

THE CAROLINA DEPOT

Navy Environmental Health Conference

Hampton, VA 2006

Introductions

- Elisabeth M. Holland, MSPH, CIH
  - Safety Director Naval Air Depot Cherry Point
  - Navy Industrial Hygienist for over 15 years
- Kathryn (Kadi) Stepp
  - Industrial Hygienist
- Thanks to Halyburton Naval Hospital IH Department and Lee Dawkins

NAVAIR

Discussion Overview

- What is chromium VI?
- Sources chromium VI in aircraft
- Sheet Metal Repair
- Sheet Metal Worker Exposures (No Engineering Controls)
- OSHA Chromium VI Standard 29 CFR 1910.1026
- Sheet Metal Engineering Controls, what worked and what did not

What is Chromium VI?

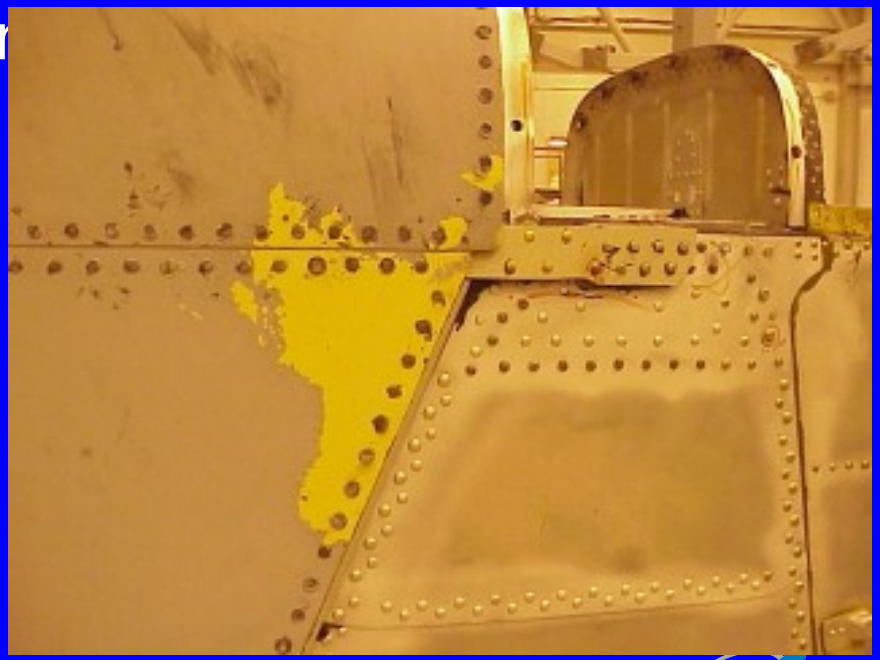
- Chromium can be:
  - Metal, chromium (0), chromium (III), chromium (VI)
- Hexavalent chromium (CrVI) is:
  - Barium chromate, chromium trioxide, strontium chromate, others
  - a specific form of chromium that causes cancer in exposed workers
- Used widely in aerospace industry

NAVAIR

Cr(VI) Containing Materials

THE CAROLINA DEPOT

- Paint Primers
- Corrosion Inhibitors
- Metal Alloys containi
- Lubricants

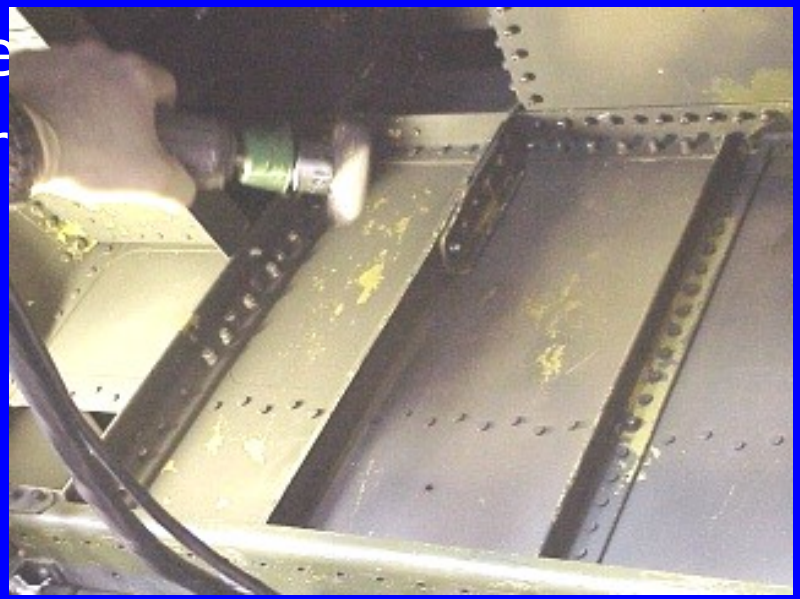


NAVAIR

Paint Primers

THE CAROLINA DEPOT

- BR-127 Corrosion Inhibiting Primer
- MIL-PRF 85582 Waterborne Epoxy Primer
- MIL-PRF-23377 Epoxy Prime
- MIL-PRF-15930 Vinyl Primer
- MIL-C-8514 Wash Primer
- Sermetel W



NAVAIR

Corrosion Inhibitors

THE CAROLINA DEPOT

- MIL-DTL-81706 Chemical Conversion Coating – Aluminum (Alodine)
- MIL-C-5514 Chemical Conversion Coating
- SAE-AMS-M-3171 Magnesium Surface Treatment
- Iridite 15 Corrosion Resistant Compound

Others

- METCO 205B Fused Ceramic Powder
- Plastic Media Blast (used)
- MIL-PRF-81322 General Purpose Aircraft Grease
- MIL-PRF-81733 Sealant

Sheet Metal Work: The Shops

THE CAROLINA DEPOT

H-53 SHEET METAL REPAIR SHOP, H53 Hangar

NAVAIR

Sheet Metal Work: The Shops

H-46 SHEET METAL SHOP, H46 Hangar

Sheet Metal Work: The Shops

THE CAROLINA DEPOT

H-1 IMC SHOP and H-1 SHEET METAL SHOP

NAVAIR

Sheet Metal Work: The Shops

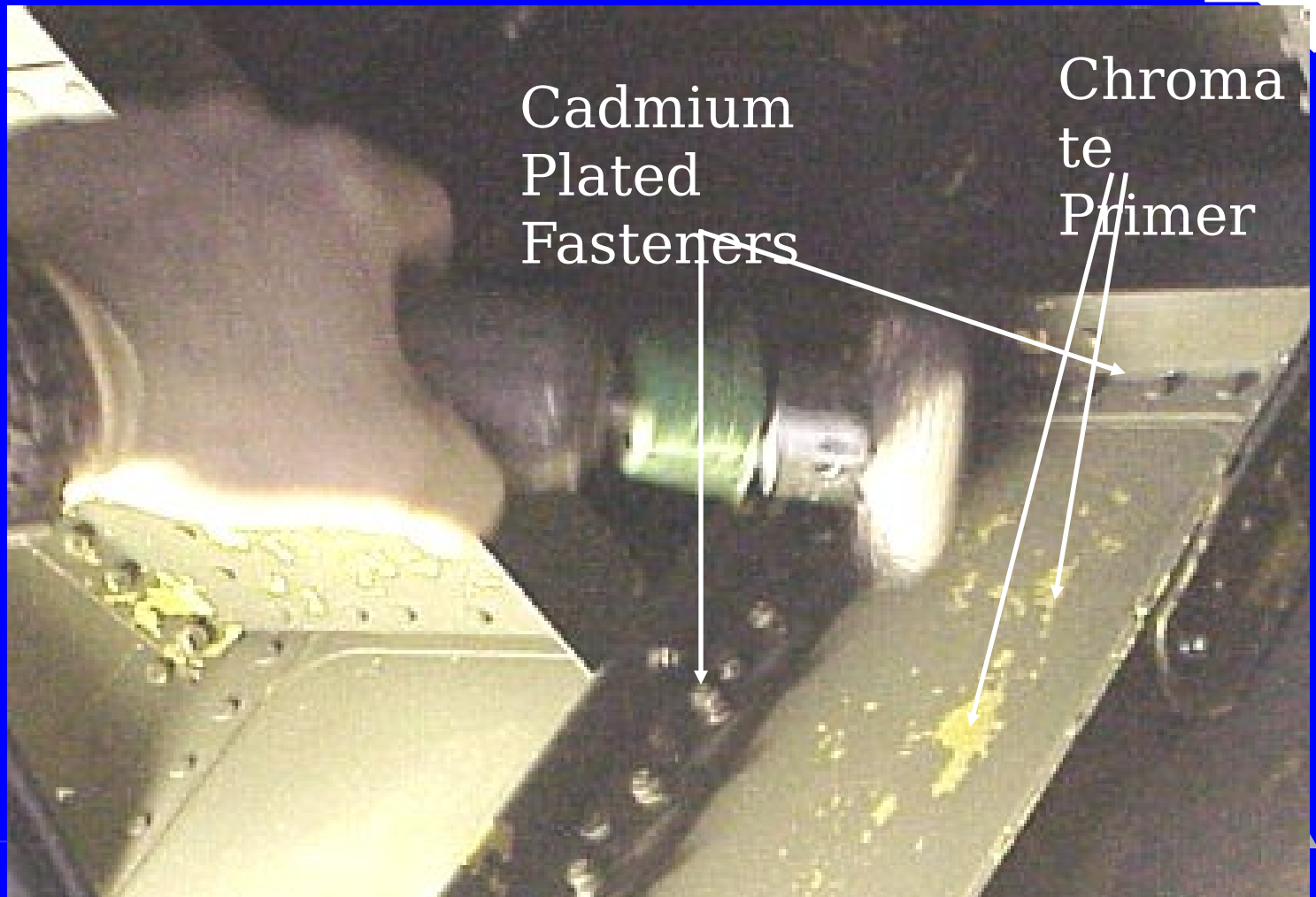
THE CAROLINA DEPOT

AV-8/H-53/H-46/ COMPONENTS SHOP

NAVAIR

Corrosion Removal Hazards

THE CAROLINA DEPOT



Chromium VI Exposures

- Sheet Metal Repair (Corrosion removal, cleaning, de-painting)
  - Up to 191 µg/m^3 8 hr TWA
- Of 97 personal samples during sheet metal repair:
  - 66% above .5 µg/m^3
  - 44% above 1 µg/m^3
  - 32% above 2.5 µg/m^3
  - 20% above 5 µg/m^3

Sheet Metal Repair Cr (VI) Exposures

- Highest exposures in “hellhole” access in tail pylon and under floorboards of H-53
- Cadmium also exceeded PEL
- Area samples during corrosion removal up to 45 $\mu g/m^3$

Sheet Metal Chromium VI Exposures

- Sheet Metal Area Samples
  - 25% above 1 µg/m^3
  - 6% above 5 µg/m^3
- OSHA Proposed Chromium VI standard set PEL at 1 µg/m^3 and Action Level at 0.5 µg/m^3
- Chromium VI Final Rule set PEL at 5 µg/m^3 and Action Level at 2.5 µg/m^3

NAVAIR

29 CFR 1910.1026 Overview

Permissible Exposure Limits:

- Action Level: 2.5 ug/m^3
- PEL: 5.0 ug/m^3
- PEL (aircraft and large component paint): 25.0 ug/m^3
- (Note the Proposed standard PEL was 1 ug/m^3)

Applies To:

- Cr(VI) in any form or compound

IH Monitoring

PPE

Regulated Areas

Engineering Controls

Hygiene Areas

Medical Surveillance

Training

NAVAIR

What NADEP CP did to prepare:

THE CAROLINA DEPOT

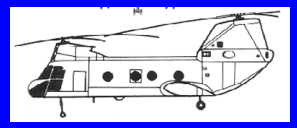
- Planning Committee
- Engineering Controls Tried and Tested
- Work isolation and scheduling
- IH sampling

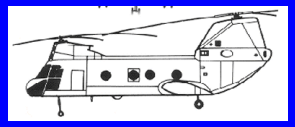
NAVAIR

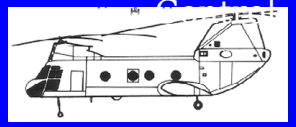
Recommendations: 1

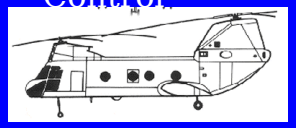
THE CAROLINA DEPOT

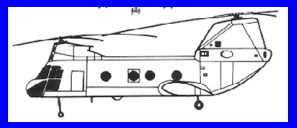
- Change the process

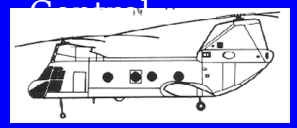

Corrosion Control


Corrosion Control

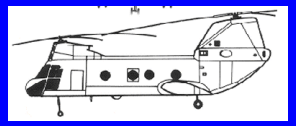

Corrosion Control

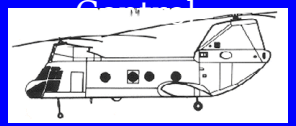

Corrosion Control


Corrosion Control


Corrosion Control

Corrosion Control


Corrosion Control


Corrosion Control

250 Workers + 300 in Area =550 Workers

Corrosion Control

50 Workers in enclosed area

Engineering Controls

THE CAROLINA DEPOT

- Walk-in Cross draft booth
- Vacuum-assisted Tools
- Glove bags on Aircraft

NAVAIR

Engineering Controls

Sheet Metal Repair Cr (VI) Exposures

- Work done both on the aircraft (H-46, H-1, H-53) and on their components
- Very different from “sanding”
- Most ventilated tools too large and designed for flat surfaces
- Variety of conventional ventilation: cross draft, down draft, glovebox

CAROLINA DEPOT

Recommendation:

Portable ventilation with specialized hoods

Results: Glove bags

- Glove bag Controls
  - In “Hell Hole” H53 tail pylon
    - TWA (Sheet Metal Worker) = 1 ug/m^3
    - TWA (Student trainee)= 1 ug/m^3
  - Under the floor boards H53
    - TWA (Sheet Metal Worker) = 5 ug/m^3
  - Zone 1 of cobra
    - TWA (15 minutes) 0.06 ug/m3
    - TWA (15 minutes) 0.13 ug/m3

Glove bags

Pros

- Complete Isolation of hazard from worker
- Relatively low cost
- IH breathing zone samples well below AL

Cons

- Awkward working postures
- Increase in production time
- Poor visibility
- Limits working area

Recommendation:

THE CAROLINA DEPOT

- Ventilated Tools

NAVAIR

Results: Vacuum Assisted Tools

- H-1 Panels
  - TWA (SMM) = 0.68 ug/m^3
  - TWA (SMM) = 1.3 ug/m^3
- H-46 Stubwing
  - TWA (SMM) = 1.9 ug/m^3
  - TWA (SMM) = 3.6 ug/m^3
- H-46 Railings
  - TWA (SMM) = 0.07 ug/m^3
- H-53 tail access Panels
  - TWA (SMM) = 0.2 ug/m^3
  - TWA (SMW) = 0.2 ug/m^3
  - TWA (SMW) = 0.5 ug/m^3

NAVAIR

Vacuum-Assisted Tooling

Pros

- IH Breathing zone air samples below AL
- Variety of tools for use on various applications

Cons

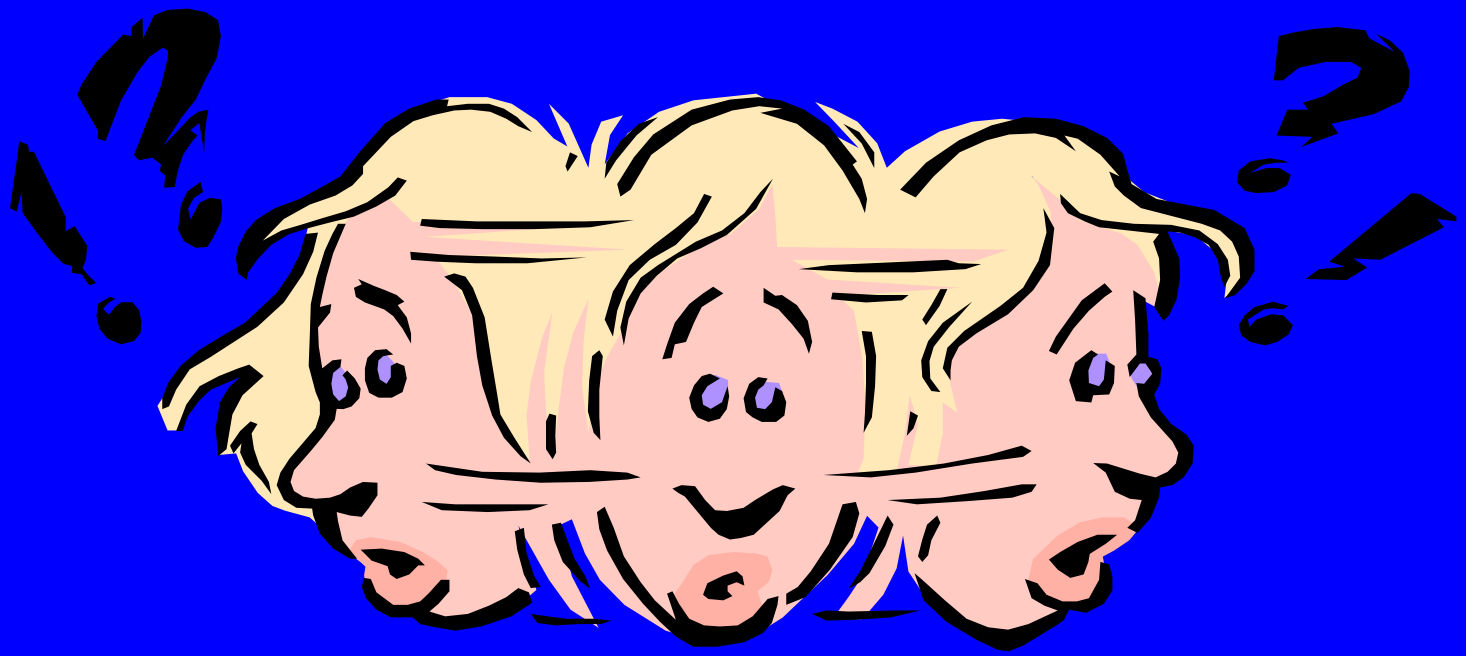
- Large Initial Investment, HEPA vacuums
- Possible wrist, arm and shoulder injuries

Conclusions

- Vacuum Tools can significantly reduce exposures to chromium VI during corrosion control work
  - May not reach all surfaces
- Glove bags can significantly reduce chromium VI exposures
  - Ergonomic problems
  - Visibility problems very significant
  - Set up and configuration problems

Questions???

THE CAROLINA DEPOT



NAVAIR

POC NADEP CP

- Elisabeth Holland: (252)464-7015

Elisabeth.holland@navy.mil

- Kathryn Stepp: (252) 464-5164

Kathryn.flores@navy.mil